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# Norms for the 5-Minute Run Test for College Men and Women

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Abstract

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Previous studies have demonstrated that the 5-minute run test (5MRT) is a valid test in determining cardiovascular (CV) endurance. This study was done to develop norms for the 5MRT for college-age students. The subjects were 195 men and 191 women attending Brooklyn College and Loma Linda University. Test-retest reliability was established (r=0.93) for the 5MRT with 20 subjects. The distance run on the 5MRT by all the subjects were used to develop norms using percentiles. Fitness categories were established using standard deviations from the mean.

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Each person whose signature appears below certifies that this manuscript in his opinion is adequate, in scope and quality, in lieu of a thesis for the degree Master of Science.

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# INTRODUCTION

Physical fitness is receiving a great deal of emphasis in our society. It is composed of six health-related components: cardiovascular (CV) endurance, body composition, flexibility, muscular strength, and muscular endurance. The one receiving the most attention is CV endurance. A minimum level of CV endurance is necessary for any activity or sport. In general, an individual with a high CV endurance capacity can perform at a higher intensity and for a longer period of time than an individual with low CV endurance.

The common way of determining the capacity of the CV system is to measure maximum oxygen consumption (VO2 max). Evaluating VO2 max directly requires expensive and sophisticated laboratory equipment, a trained staff, and a full maximal effort from the subject. This is not a feasible test for large samples. Since the evaluation of VO2 max is important in determining the physical fitness of individuals, numerous tests have been developed to predict VO2 max. Such tests usually require a submaximal effort, utilize little equipment, and are easily administered. Examples are step tests (1, 5, 7, 13, 15, 17), bicycle ergometer tests (6, 10), and field tests (3, 7, 14).

Many researchers have shown a linear relationship between measured VO2 max and distance run during field tests. Balke (3) was the first to develop a field test designed to evaluate aerobic capacity based upon the distance run in a 15-minute period. Cooper modified Balke's test and designed what is today, perhaps the most widely used test, the 12-minute run test (12MRT) (7). Cooper reported a correlation of 0.897 when comparing distance run in 12-minutes with VO2 max.

The relationship between VO2 max and the 12MRT has been investigated by many researchers. Correlations have ranged from 0.34 to 0.94 (6, 9, 11, 16, 18). Katch (11) suggests that the reason for the lower correlations could be partially due to the homogeneity of the

sample. The sample from Cooper's original study (7) had wide ranges in age (17-54 yrs), in body weight (114-270 lbs), in VO2 max (31-59 ml/kg/min), and in running scores on the 12MRT (1.11-2.13 miles). Disch (9) proposes that the variability may be due to sampling error but adds that it could also be due to the low number of subjects selected in some studies.

Baumgartner and Jackson (4) add three more possibilities for the range in correlations - lack of pace standardization, motivation, and pain threshold. In a laboratory, the running pace is standardized by the selection of a specific speed on the treadmill, while on a field test, the subjects select the speed and must learn to pace themselves. In order to give an all-out effort for the field test, the subject must be highly motivated. Psychological factors can have a big effect on the outcome of field tests. If subjects have low pain thresholds, which is common in unfit individuals, running all-out for a long period of time is unbearable. Cooper suggests that individuals should not take the 12MRT until after at least 6-weeks of training (8).

Katch (12) showed that the highest correlations between running distance and VO2 max were obtained after at least 5-minutes of running with no significant increases beyond 5-minutes. Michielli (14) developed a 5-minute run test (5MRT) for college men and women. He tested 23 subjects and reported a correlation of 0.89 when comparing distance run with VO2 max. Using 24 physically active college male subjects, Perry (16) compared the 5MRT to the 12MRT and found that both the field tests had significant correlations of 0.76 and 0.70, respectively, when compared with VO2 max. She concluded by stating that the 5MRT may be an effective substitute for the 12MRT. It appears, then, that the 5MRT is an acceptable test to use on college-age students to determine CV capacity.

Norms are standards to which obtained scores may be compared. They provide information to interpret individual scores in relation to the scores made by other individuals in the same population. As no norms have been developed, the purpose of this study was to establish norms for the 5MRT for college men and women.

# METHODS

## Subjects

To compile data for the establishment of norms, the 5MRT was administered to college men and women at two locations - City University of New York, Brooklyn College, Brooklyn, New York (BC) and Loma Linda University, La Sierra Campus, Riverside, California (LLU). The subjects were 195 men, 149 from BC and 46 from LLU with a mean age of 20.6 years (SD=1.9), and 191 women, 135 from BC and 57 from LLU with a mean age of 19.9 years (SD=2.1).

The subjects from BC were students enrolled in a 10-week body conditioning course which met two times per week. Each session was divided into two portions - 20 minutes of interval running and 20 minutes of weight training. The subjects from LLU were volunteers, except for 7 men and 20 women enrolled in a 10-week jogging course which met two times per week for 50 minutes per session.

## Measurement

The running tracks used for the 5MRT were an outdoor 400-meter rubber track at BC and an outdoor 400-meter dirt track at LLU. On both tracks, indicators were placed one meter apart to enable the tester to measure the distance run. The subjects, at BC, were tested before and after the training period during fall, spring, and summer semesters, while the subjects at LLU were tested during the Spring. The 27 jogging students, from LLU were tested at the end of the Spring quarter.

Prior to testing, informed consent was obtained. All subjects were instructed to run the greatest distance that they could in five minutes. No instructions were given concerning warming up. The subjects were instructed to begin the run with the words "Ready, go." As

each subject passed the starting point, on subsequent laps, elapsed time would be called out. The blow of a whistle marked the end of the 5-minute period at which point the subjects were to stop running and remain stationary. The tester would then go around the track and record, to the nearest meter, the distance run by each subject. Subjects were tested at various times of day (6AM-6PM) in groups ranging from 5 to 15. The test was administered during normal weather conditions and extremes were avoided.

Twenty LLU subjects, 10 men and 10 women, were given the test two times, one week apart, to establish test-retest reliability. The scores from BC and LLU were combined and norms were developed using percentiles.

## RESULTS AND DISCUSSION

Reliability was determined using the test-retest method which produced a correlation of 0.93. This related very well with the reliabilities obtained by Michielli (9) and Perry (14) of 0.85 and 0.94 respectively.

Scores from BC and LLU were combined and separate percentile norms were developed for men and women by the use of the mean, standard deviation, and a normal distribution table (table 1 and table 2). Percentiles were located on a normal distribution table and the Z-scores determined. The standard deviation was multiplied by the Z-score and the obtained number was either added to the mean. The column predicting VO2 max was established using the regression equation developed by Michielli (9) Y= -1.742 + 0.043 X, where Y is the VO2 max in ml/kg/min and X is the distance run in meters.

From the norm tables, categories were developed in the following manner: the superior category included scores two standard deviations (SD) above the mean and beyond, the excellent category included scores from 1 SD above the mean to 2 SD above the mean, the good category included scores from the mean to 1 SD above the mean, the average category included scores from 1 SD below the mean to the mean, the below average category included scores from 2 SD below the mean to 1 SD below the mean, and the low category included scores from 2 SD below the mean and below (table 3 and table 4). The tables include the distance run in meters and the predicted VO2 max. When the predicted VO2 max categories devised from the data collected in the present study were compared to those from the age related norms developed by Astrand (2) and Cooper (8), they compared closely with Astrand's categories but were more rigorous than Cooper's.

The 5MRT has been shown to be a good test for evaluating CV endurance for college-age students. It has advantages over the 12MRT in that it is shorter and requires a less strenu-

ous effort and less motivation. The norms developed in this study provide guidelines that can be used in evaluating CV capacity for college men and women.

**Table 1. Norms for the 5-Minute Run Test for College Men.**

| PERCENTILES | DISTANCE RUN (METERS) | PREDICTED VO2 MAX (ML/KG/MIN) |
|---|---|---|
| 99 | 1,551 | 65 |
| 95 | 1,444 | 60 |
| 90 | 1,387 | 58 |
| 85 | 1,349 | 56 |
| 80 | 1,318 | 55 |
| 75 | 1,292 | 54 |
| 70 | 1,268 | 53 |
| 65 | 1,247 | 52 |
| 60 | 1,225 | 51 |
| 55 | 1,206 | 50 |
| 50 | 1,186 | 49 |
| 45 | 1,166 | 48 |
| 40 | 1,147 | 48 |
| 35 | 1,125 | 47 |
| 30 | 1,104 | 46 |
| 25 | 1,080 | 45 |
| 20 | 1,054 | 44 |
| 15 | 1,023 | 42 |
| 10 | 985 | 41 |
| 5 | 928 | 38 |
| 1 | 821 | 34 |
| X=1186 SD=157 N=344 | | |

**Table 2. Norms for the 5-Minute Run Test for College Women.**

| PERCENTILES | DISTANCE RUN (METERS) | PREDICTED VO2 MAX (ML/KG/MIN) |
|---|---|---|
| 99 | 1,280 | 53 |
| 95 | 1,182 | 49 |
| 90 | 1,129 | 47 |
| 85 | 1,094 | 45 |
| 80 | 1,066 | 44 |
| 75 | 1,042 | 43 |
| 70 | 1,020 | 42 |
| 65 | 1,001 | 41 |
| 60 | 981 | 40 |
| 55 | 963 | 40 |
| 50 | 945 | 39 |
| 45 | 927 | 38 |
| 40 | 909 | 37 |
| 35 | 889 | 36 |
| 30 | 870 | 36 |
| 25 | 848 | 35 |
| 20 | 824 | 34 |
| 15 | 796 | 32 |
| 10 | 761 | 31 |
| 5 | 708 | 29 |
| 1 | 610 | 24 |
| X=945 SD=144 N=327 | | |

**Table 3. Fitness Categories for College Men for the 5-Minute Run Test (5MRT). Comparisons with Cooper's and Astrand's Categories.**

| CATEGORY | COOPER (1) VO2 MAX (ML/KG/MIN) | ASTRAND (2) VO2 MAX (ML/KG/MIN) | 5MRT VO2 MAX PREDICTED (ML/KG/MIN) | DISTANCE RUN ON 5MRT (METERS) |
|---|---|---|---|---|
| SUPERIOR | >52.5 | >63 | >64 | >1,529 |
| EXCELLENT | 46.5-52.4 | 57-62 | 57-63 | 1,366-1,528 |
| GOOD | 42.5-46.4 | 52-56 | 50-56 | 1,203-1,365 |
| AVERAGE | 36.5-42.4 | 44-51 | 44-49 | 1,064-1,202 |
| BELOW AVERAGE | 33.0-36.4 | 39-43 | 36-43 | 878-1,063 |
| LOW | <33.0 | <38 | <35 | <877 |

(1) Cooper, K.H. *The Aerobics Way*. New York, Bantam Books 1977, p.282.

(2) Astrand, O. Aerobic work capacity in men and women with special reference to age. *ACTA Physiol. Scand.* 49(Suppl):169, 1960.

**Table 4. Fitness Categories for College Women for the 5-Minute Run Test (5MRT). Comparisons with Cooper's and Astrand's Categories.**

| CATEGORY | COOPER (1) VO2 MAX (ML/KG/MIN) | ASTRAND (2) VO2 MAX (ML/KG/MIN) | 5MRT VO2 MAX PREDICTED (ML/KG/MIN) | DISTANCE RUN ON 5MRT (METERS) |
|---|---|---|---|---|
| SUPERIOR | >41.0 | >54 | >51 | >1,227 |
| EXCELLENT | 37.0-40.9 | 49-53 | 45-50 | 1,087-1,226 |
| GOOD | 33.0-36.9 | 44-48 | 39-44 | 947-1,086 |
| AVERAGE | 29.0-32.9 | 35-43 | 33-38 | 808-946 |
| BELOW AVERAGE | 23.6-28.9 | 29-34 | 27-32 | 668-807 |
| LOW | <23.6 | <28 | <26 | <667 |

(1) Cooper, K.H. *The Aerobics Way*. New York, Bantam Book, 1977, p.282.

(2) Astrand, O. Aerobic work capacity in men and women with special reference to age. *ACTA Physiol. Scand.* 49(Suppl):169, 1960.

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